

REMARKS

The Office Action mailed January 13, 2004 has been carefully reviewed and the following remarks are made in consequence thereof.

Claims 1-31 are now pending in this application. Claims 1-31 stand rejected.

Preliminarily, Applicants wish to respond to the Response to Arguments section of the Office Action. The Office Action states the following:

Hawthorne discusses measuring speed and acceleration with a conventional odometer. This would be an inertial measurement.

Applicants respectfully disagree that a conventional odometer can be fairly considered an inertial measurement. Applicants can find no mention of an odometer within Hawthorne, and no mention of an instrument used to determine speed and acceleration other than at Column 15, lines 56-60, where Hawthorne states the following:

Based on Newton's laws of motion and train weight (W), LEADER calculates train deceleration at time=TSTOP, $A=K * (FB+FR)/W$. LEADER integrates calculated acceleration to determine speed at time=TSTOP, $V=V+A*DT$. LEADER integrates speed to determine stopping distance and track location at time=TSTOP...

In the above equation, A represents acceleration, K appears to be a constant, FB represents train brake retardation (FB) forces from brake cylinder pressures, and car brake rigging, FR represents retardation forces imparted to the train (FR) due to grades, curves, and rolling resistance effects, and W represents the weight of the train. In addition, Figure 2 illustrates a plurality of "locomotive sensor array" lines that appears to provide inputs to an I/O concentrator, but no further description of the "locomotive sensor array" could be found. Moreover, even if Hawthorne did describe a conventional odometer, it is not understood how a conventional odometer can be considered an inertial measurement, as a conventional odometer does not use the property of inertia, but rather counts a rotation of the train wheels.

The rejection of Claims 1-31 under 35U.S.C. §112, second paragraph is respectfully traversed. It is respectfully submitted that Applicants have not elected to be their own lexicographer in this instance, and that the term “heading” is not used by the claim to mean “direction of travel”, but rather the use of the term “heading” is modified and limited by the phrase "wherein the heading represents both the direction of travel of the locomotive and which end of the locomotive is in the lead in the direction of travel" in Applicants' specification and claims. Such a definition of heading is entirely consistent with the ordinary meaning of heading, as would be understood by one of ordinary skill in the art at the time the application was filed. Specifically, Applicants respectfully submit that the phrase "wherein the heading represents both the direction of travel of the locomotive and which end of the locomotive is in the lead in the direction of travel" only modifies the common meaning of the term “heading” such that a locomotive traveling in a consist and with a cab forward configuration has generally the same heading, or direction of travel, as a locomotive traveling in the same consist in a cab reverse configuration.

Moreover, Applicants respectfully submit both the term “heading” and the phrase "wherein the heading represents both the direction of travel of the locomotive and which end of the locomotive is in the lead in the direction of travel" are defined in the specification and support the definiteness of the recitations within the claims. For example, at page 1, lines 6-7 the specification recites the invention as “determining movement and direction of a track-bound transportation apparatus using GPS satellites.” At page 6, line 6, for example, heading is recited as being equal to $\tan^{-1}d_x/d_y$, wherein d_x and d_y are vector components of the vector distance between the two antennas, within an x , y , and z coordinate system, defined on page 5, lines 3-4 as being referenced to “east, north and up, respectively.”

As a vector quantity, the vector distance between the two antennas has both a magnitude component and a direction component. The method of the present invention uses the two antennas to determine the vector distance between the two antennas. The two antennas are mounted on the locomotive spaced apart by a known distance magnitude. With the vector distance between the two antennas known and the distance magnitude between the two antennas known, it is elementary to determine the direction component of the distance vector. Further, each GPS system determines the absolute position of its respective antenna. Accordingly, the direction component of the heading vector of the longitudinal axis of the locomotive is known and the absolute position of each antenna is known, therefore the

heading of the locomotive is known and which antenna is in the lead is known (from the absolute position). Applicants respectfully submit that the original specification describes an accurate heading of the locomotive during normal locomotive transit operation using the set of phase differences between the satellite reference signals, wherein the locomotive is self-propelled or propelled in a consist with other locomotives, wherein the heading represents both the direction of travel of the locomotive and which end of the locomotive is in the lead in the direction of travel of the locomotive.

The accuracy of the heading determination during some portions of travel, such as traveling through or entering curves, is not claimed nor addressed in the specification and may also be affected by other operations that are also not addressed in the claims or specification. With respect to the arguments set forth with respect to Claims 1-31, Applicants respectfully submit that one of ordinary skill in the art after reading the original specification, in light of the figures, would understand what is meant by the term "heading" as modified by the phrase "wherein the heading represents both the direction of travel of the locomotive and which end of the locomotive is in the lead in the direction of travel."

Applicants further submit that the dictionary definition relied on in the Office Action is incomplete with respect to locomotives. Specifically, the dictionary definition of heading cited in the Office Action uses a ship and an aircraft as exemplary vehicles for which the definition of heading applies. It is known that ships rarely travel in a reverse direction except for maneuvering close to berth, and aircraft are incapable of normal operation in a reverse direction, but locomotives routinely travel extended distances in a cab forward configuration or a cab reverse configuration. A consist may include any number of locomotives operating in a cab forward configuration in tandem with any number of locomotives operating in a cab reverse configuration. In this scenario, using the dictionary definition of heading, the heading of the locomotives in the cab reverse configuration is approximately one hundred and eighty degrees displaced from the heading of the locomotives in the cab forward configuration. Using the term "heading", as modified by the phrase "wherein the heading represents both the direction of travel of the locomotive and which end of the locomotive is in the lead in the direction of travel permits all locomotives in a consist, whether in a cab forward or cab reverse configuration to determine their direction of travel accurately. Generally, the direction of travel of a consist or a single locomotive is of interest and not the compass

direction in which the longitudinal axis points. Accordingly, Applicants submit that Claims 1-31 meet the requirements of section 112, second paragraph.

For the reasons set forth above, Applicants respectfully request that the Section 112 rejection of Claims 1-31 be withdrawn.

The rejection of Claims 1-5, 12-19, and 28-31 under 35 U.S.C. § 103 as being unpatentable over Bruckner (U.S. Pat. No. 6,266,582) in view of Hawthorne (U.S. Pat. No. 6,263,266) is respectfully traversed.

Bruckner describes a global positioning system (GPS) backup for an inertial measurement unit having dual GPS receivers 10 that utilize two antennas (12, 14), one antenna for each channel. The GPS provides coordinate information for the location of each of the antennas, therefore the attitude, and any change thereof, of the aircraft perpendicular to the antenna directional axis 18 may be determined by solving the two-point equation for the line which passes through the antenna coordinates. Determination of the rate of change of the attitude of the aircraft 16 may be determined by evaluation of the change in the coordinate positions of the antennas (12, 14) with respect to a given time reference which is also provided in the GPS signal. Thus, a dual GPS receivers system utilizing a two antenna installation may provide the same information and functionality of two axis IMUs, which provide information concerning the orientation of the airplane with respect to a reference plane, typically the ground.

Notably, Bruckner does not describe nor suggest determining an accurate **heading** of a locomotive wherein the heading represents the direction of travel of the locomotive with either end thereof in the lead in the direction of travel of the locomotive.

Hawthorne describes a method of optimizing train operation and training in a moving train that includes determining the train's conditions and calculating a desired response to the present conditions of the train to achieve a goal. The method of optimizing train operation includes determining conditions of location, track profile and train forces of the train. A set of preliminary train restraint operating parameters are determined from the determined conditions. Also, a set of preliminary train optimizable operating parameters to minimize train forces, to maximize fuel efficiency and to minimize time to destination is determined.

Notably, Hawthorne does not describe nor suggest an inertial measurement system. Therefore there is no motivation to provide for a redundant inertial measurement system as asserted in the Office Action. In addition, Hawthorne, also does not describe nor suggest determining an accurate **heading** of a locomotive wherein the heading represents the direction of travel of the locomotive with either end thereof in the lead in the direction of travel of the locomotive.

Applicants disagree with the assertion in the Office Action that a conventional odometer is an inertial device and Applicants reiterate that Hawthorne does not describe nor suggest an inertial measurement system. Hawthorne does not describe nor suggest determining the heading of a locomotive wherein the heading represents the direction of travel of the locomotive, nor does Hawthorne describe or suggest an inertial measurement system.

Since Bruckner only suggests using GPS to backup an inertial measurement system due to the cost of redundant inertial measurement systems, and Hawthorne does not describe nor suggest an inertial measurement system, the teaching and motivation for combining Bruckner with Hawthorne could not have come from Bruckner or Hawthorne, and therefore the combination is improper.

At column 3, lines 5-7, Bruckner recites "a dual GPS receivers system utilizing a two antenna installation may provide the same information and functionality of two axis IMUs." Further, at column 3, lines 9-14, Bruckner recites "an aircraft may utilize a dual IMU (gyroscope) installation...wherein the first IMU 20 may provide attitude and rate of change of attitude about a first directional axis 22 (e.g., the left side of the aircraft) and a IMU 24 may provide attitude and rate of change of attitude about a second directional axis." Accordingly, Bruckner only describes an IMU providing attitude and rate of change of attitude information and that a dual GPS receiver system utilizing a two antenna installation may provide the same information and functionality of two axis IMUs and does not describe nor suggest heading information being provided by the IMUs or the GPS system.

Although it is asserted within the Office Action that Bruckner teach the present invention except for disclosing the vehicle is a locomotive, and that Hawthorne discloses a vehicle that is a locomotive, no motivation nor suggestion to combine the cited art has been shown. Since there is no teaching nor suggestion in the cited art for the claimed combination,

the Section 103 rejection is based on a hindsight reconstruction in which isolated disclosures have been picked and chosen in an attempt to deprecate the present invention. Of course, such a combination is impermissible, and for this reason alone, Applicants request that the Section 103 rejection of Claims 1-5, 12-19, and 28-31 be withdrawn.

Furthermore, Applicants respectfully submit that no motivation for the combination can be found within Bruckner and Hawthorne, as Bruckner and Hawthorne teach away from each other. Bruckner describe, at column 3, lines 5-7, a GPS receiver antenna system that may provide the same information and functionality of two axis inertial measurement units (IMUs) and at column 1, lines 18-20, that IMUs provide information concerning the orientation of the airplane with respect to a reference plane, typically the ground. In addition, Bruckner describes, at column 3, lines 40-44, that using three GPS receivers and three antennas strategically mounted on the aircraft, three dimensional inertial information about three orthogonal axes of the aircraft may be obtained and at column 3, lines 52-53 that relative rotational movement of both antennas 14 and 20 with respect to antenna 12 may provide a combination of roll, pitch and yaw information. Clearly, the three orthogonal axes of the aircraft are roll, pitch and yaw information and not heading information wherein the heading represents the direction of travel. Specifically, Bruckner do not describe nor suggest determining an accurate heading of the locomotive, wherein the heading represents the direction of travel of the locomotive with either end thereof in the lead in the direction of travel of the locomotive.

In contrast, Hawthorne describes determining a position of a lead locomotive of a train consist using a GPS and does not describe nor suggest determining an accurate heading of the locomotive, wherein the heading represents both the direction of travel of the locomotive and which end of the locomotive is in the lead in the direction of travel of the locomotive. Specifically, at column 10, lines 36-38, Hawthorne describes "a geographical positions system (GPS) which is used to detect the precise latitude and longitude of the head of the train", and at column 5, lines 60-62 that "[p]osition is determined from wheel movement sensors and a Global Positioning System (GPS)."

If art "teaches away" from a claimed invention, such a teaching supports the nonobviousness of the invention. U.S. v. Adams, 148 USPQ 479 (1966); Gillette Co. v. S.C. Johnson & Son, Inc., 16 USPQ2d 1923, 1927 (Fed. Cir. 1990). In light of this standard, it is respectfully submitted that the cited art, as a whole, is not suggestive of the presently claimed

invention. More specifically, Applicants respectfully submit that Hawthorne teaches away from Bruckner, and as such, there is no suggestion or motivation to combine Bruckner with Hawthorne.

Further, and to the extent understood, no combination of Bruckner and Hawthorne, describes or suggests the claimed combination, and as such, the presently pending claims are patentably distinguishable from the cited combination. Specifically, Claim 1 recites a method that includes “determining an accurate heading of the locomotive during normal locomotive transit operation using the set of phase differences between the satellite reference signals, wherein the locomotive is self-propelled or propelled in a consist with other locomotives, wherein the heading represents both the direction of travel and which end of the locomotive is in the lead in the direction of travel of the locomotive.”

The combination of Bruckner and Hawthorne does not describe nor suggest a method that includes determining an accurate heading of the locomotive during normal locomotive transit operation using the set of phase differences between the satellite reference signals, wherein the locomotive is self-propelled or propelled in a consist with other locomotives, wherein the heading represents both the direction of travel and which end of the locomotive is in the lead in the direction of travel of the locomotive. Accordingly, for at least the reasons set forth above, Claim 1 is submitted to be patentable over Bruckner in view of Hawthorne.

Claims 2-14 and 30 are dependent from independent Claim 1, and are respectfully submitted to be patentable along with and for the same reasons as Claim 1.

Claim 15 recites an apparatus for determining at least one of motion and location parameters of a railroad locomotive to detect curves and reduce track wear, with the locomotive oriented with either end of the locomotive in the lead in the direction of travel of the locomotive wherein the apparatus includes “at least two phase-locking satellite receivers configured to reference signals received from a set of satellites...a processor configured to determine a set of phase differences between the reference signals received by said satellite receivers and an accurate heading of the locomotive during normal locomotive transit operation using the set of phase differences between the reference signals, wherein the locomotive is self-propelled or propelled in a consist with other locomotives, wherein the heading represents both the direction of travel of the locomotive and which end of the locomotive is in the lead in the direction of travel of the locomotive.”

Applicants respectfully submit that the proposed modification would render the proposed combination of prior art references unsatisfactory for its intended purpose. Applicants respectfully submit that flying an aircraft "with either end thereof in the lead in the direction of travel" would render the airplane unsatisfactory for its intended purpose therefore there is no suggestion or motivation to make the proposed modification. Further, Applicants submit there is no motivation to determine the attitude of an aircraft when an aircraft is being moved in reverse on the ground at an airport, as the aircraft is not in control of its attitude and assumes the known attitude of the runway, tarmac, or taxiway, therefore a backup system to an attitude determining system is unsatisfactory for its intended purpose of providing backup at a lower cost than inertial measurement systems.

Furthermore, the combination of Bruckner and Hawthorne does not describe nor suggest an apparatus for determining at least one of motion and location parameters of a locomotive to detect curves and reduce track wear, with either end of the locomotive in the lead in the direction of travel of the locomotive wherein the apparatus includes at least two phase-locking satellite receivers configured to reference signals received from a set of satellites, a processor configured to determine a set of phase differences between the reference signals received by the satellite receivers and an accurate heading of the locomotive during normal locomotive transit operation using the set of phase differences between the reference signals, wherein the locomotive is self-propelled or propelled in a consist with other locomotives, wherein the heading represents the direction of travel of the locomotive with either end thereof in the lead in the direction of travel of the locomotive.

Specifically, neither Bruckner nor Hawthorne, alone or in combination describe or suggest a processor configured to determine a set of phase differences between the reference signals received by the satellite receivers and an accurate heading of the locomotive during normal locomotive transit operation using the set of phase differences between the reference signals, wherein the locomotive is self-propelled or propelled in a consist with other locomotives, wherein the heading represents the direction of travel of the locomotive with either end thereof in the lead in the direction of travel of the locomotive. Accordingly, for at least the reasons set forth above, Claim 15 is submitted to be patentable over Bruckner in view of Hawthorne.

Claims 16-31 are dependent from independent Claim 15, and are respectfully submitted to be patentable along with and for the same reasons as Claim 15.

The rejection of Claims 10, 11, and 24-27 under 35 U.S.C. § 103 as being unpatentable over Bruckner in view of Hawthorne and further in view of Kumar (U.S. Pat. No. 5,896,947) is respectfully traversed.

Claims 10 and 11 depend, directly or indirectly, from independent Claim 1, which is submitted to be patentable for the reasons set forth above. When the recitations of Claims 10 and 11 are considered in combination with the recitations of Claim 1, Applicants submit that Claims 10 and 11 likewise are patentable over Bruckner in view of Hawthorne, and further in view of Kumar.

Claims 24-27 depend, directly or indirectly, from independent Claim 15, which is submitted to be patentable for the reasons set forth above. When the recitations of Claims 24-27 are considered in combination with the recitations of Claim 15, Applicants submit that Claims 24-27 likewise are patentable over Bruckner in view of Hawthorne, and further in view of Kumar.


The rejection of Claims 6-9, and 20-23 under 35 U.S.C. § 103 as being unpatentable over Bruckner in view of Hawthorne and further in view of Bidaud (U.S. Pat. No. 6,347,265) is respectfully traversed.

Claims 6-9 depend, directly or indirectly, from independent Claim 1, which is submitted to be patentable for the reasons set forth above. When the recitations of Claims 6-9 are considered in combination with the recitations of Claim 1, Applicants submit that Claims 6-9 likewise are patentable over Bruckner in view of Hawthorne, and further in view of Bidaud.

Claims 20-23 depend, directly or indirectly, from independent Claim 15, which is submitted to be patentable for the reasons set forth above. When the recitations of Claims 20-23 are considered in combination with the recitations of Claim 15, Applicants submit that Claims 20-23 likewise are patentable over Bruckner in view of Hawthorne, and further in view of Bidaud.

In view of the foregoing amendments and remarks, all the claims now active in this application are believed to be in condition for allowance. Reconsideration and favorable action is respectfully solicited.

Respectfully Submitted,

A handwritten signature in black ink, appearing to read 'Zychlewicz', written over a horizontal line.

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